

In the Claims

Claims 102-124, 126-131, and 133-139 are pending in the application with claims 102, 110, 118, 129, and 135 amended herein and claim 135 previously withdrawn.

Claims 1-101 (cancelled).

102. (currently amended) A method for forming an insulative layer having a relatively low dielectric constant comprising:

loading a substrate including at least partially formed integrated circuitry thereon into a reaction chamber for a plasma enhanced chemical vapor deposition apparatus;

with the substrate in the reaction chamber, chemically vapor depositing a first layer, having a first dielectric constant and comprising silicon atoms bonded to carbon atoms, over the substrate and on the at least partially formed integrated circuitry by introducing into the reaction chamber a gaseous material precursor and a dry oxygen-comprising gaseous material while generating a plasma in the reaction chamber; and

after depositing, blanket exposing the first layer to an oxygen comprising plasma ~~effective to form~~ that forms the low dielectric constant insulative layer from the first layer, ~~effective to reduce~~ that reduces the first dielectric constant to a second dielectric constant that is the relatively low dielectric constant for the insulative layer, ~~effective to allow~~ that allows a base chemistry of the whole deposited first layer to remain substantially without transformation to another base chemistry after the blanket exposing converts the first layer to the insulative layer, and ~~ineffective to~~ that does not appreciably etch the first layer.

103. (previously presented) The method of claim 102, wherein the dry oxygen-comprising gaseous material is selected from a group consisting of oxygen, ozone, nitrous oxide, NO_x and mixtures thereof.

104. (previously presented) The method of claim 102, where blanket exposing comprises employing the dry oxygen-comprising gaseous material to form the oxygen comprising plasma.

105. (previously presented) The method of claim 104, where the dry oxygen-comprising gaseous material is selected from a group consisting of oxygen, ozone, nitrous oxide, NO_x and mixtures thereof.

106. (previously presented) The method of claim 102, wherein the dry oxygen-comprising gaseous material is chosen from a group consisting of CO, CO₂, NO₂ or NO_x and the oxygen comprising plasma is formed employing a gas selected from a group consisting of oxygen or ozone.

107. (previously presented) The method of claim 102, wherein the gaseous material precursor is a methylsilane compound.

108. (previously presented) The method of claim 102, wherein the gaseous material precursor is a methylsilane compound and the dry oxygen-comprising gaseous material is selected from a group consisting of oxygen, ozone, nitrous oxide, NO_x and mixtures thereof.

109. (previously presented) The method of claim 108, where the oxygen comprising plasma is formed employing another, different oxygen-comprising gaseous material selected from a group consisting of oxygen, ozone, nitrous oxide, NO_x and mixtures thereof.

110. (currently amended) The method of claim 102, where blanket exposing is ~~effective to increase~~ increases stability of the second dielectric constant to variation compared to stability of the first dielectric constant.

111. (previously presented) The method of claim 102, where blanket exposing occurs within the reaction chamber without removing the substrate from the reaction chamber between chemical vapor depositing and blanket exposing.

112. (previously presented) The method of claim 102, wherein a temperature of the substrate during blanket exposing is always less than or equal to 550°C.

113. (previously presented) The method of claim 102, where blanket exposing occurs at a RF power range of from 300 to 1000 Watts, a pressure range of from 1 to 6 Torr, and a temperature range of from 100 to 450°C.

114. (previously presented) The method of claim 102, wherein the blanket exposing occurs between plates of a dual plate capacitively coupled reactor at a plate spacing of from 400 to 600 mils.

115. (previously presented) The method of claim 102, where at least some of the carbon atoms are present within a CH₃ group.

116. (previously presented) The method of claim 102, where the first layer comprises $(\text{CH}_3)_x\text{SiO}_y$ which remains substantially as $(\text{CH}_3)_x\text{SiO}_y$ after blanket exposing converts the first layer to the insulative layer.

117. (previously presented) The method of claim 102, where the whole first layer comprises $(\text{CH}_3)_x\text{SiO}_y$ all of which remains substantially as $(\text{CH}_3)_x\text{SiO}_y$ after blanket exposing converts the first layer to the insulative layer, and wherein blanket exposing comprises blanket exposing for at least 20 seconds.

118. (currently amended) The method of claim 102, where the first layer comprises silicon atoms bonded to carbon atoms, the silicon atoms in the whole deposited first layer remain substantially as silicon atoms bonded to carbon atoms after the blanket exposing converting the first layer to the insulative layer, and the blanket exposing comprises blanket exposing for at least 20 seconds.

119. (previously presented) The method of claim 102, where the first layer comprises silicon atoms bonded to carbon atoms, the silicon atoms in the whole deposited first layer remain substantially as silicon atoms bonded to carbon atoms after the blanket exposing converting the first layer to the insulative layer, and the blanket exposing comprises blanket exposing for at least 40 seconds.

120. (previously presented) The method of claim 102, where the first layer comprises silicon atoms bonded to carbon atoms, the silicon atoms in the whole deposited first layer remain substantially as silicon atoms bonded to carbon atoms after the blanket exposing converting the first layer to the insulative layer, and the blanket exposing comprises blanket exposing for from 20 seconds to 100 seconds.

121. (previously presented) The method of claim 102, wherein the first layer comprises silicon atoms bonded to carbon atoms, the silicon atoms in the whole deposited first layer remain substantially as silicon atoms bonded to carbon atoms after the blanket exposing converting the first layer to the insulative layer, and the blanket exposing comprises blanket exposing for at least 100 seconds.

122. (previously presented) The method of claim 102 wherein the majority of the carbon atoms present in the first layer are in the form of methyl groups, and wherein the methyl groups comprise from 10% to about 50% (mole percent) of the first layer.

123. (previously presented) The method of claim 102 wherein the majority of the carbon atoms present in the insulative layer are in the form of methyl groups, and wherein the methyl groups comprise from 10% to about 50% (mole percent) of the insulative layer.

124. (previously presented) The method of claim 102, wherein the insulative layer is configured to act as an interlevel dielectric layer.

125. (cancelled).

126. (previously presented) The method of claim 102, wherein the second dielectric constant is about ten percent less than the first dielectric constant.

127. (previously presented) The method of claim 102, wherein the second dielectric constant is about fifteen percent less than the first dielectric constant.

128. (previously presented) The method of claim 102, wherein the second dielectric constant is in a range of about 2.5 to 2.0.

129. (currently amended) A method for forming an insulative layer having a low dielectric constant comprising:

loading a substrate including at least partially formed integrated circuitry thereon into a reaction chamber for a plasma enhanced chemical vapor deposition apparatus;

with the substrate in the reaction chamber, chemically vapor depositing a first layer, having a first dielectric constant, over the substrate and on the at least partially formed integrated circuitry by introducing into the reaction chamber a gaseous material precursor and a dry oxygen-comprising gaseous material while generating a plasma in the reaction chamber; and

after depositing, blanket exposing the first layer to an oxygen comprising plasma ~~effective to form~~ that forms the insulative layer from the first layer, ~~effective to reduce~~ that reduces the first dielectric constant to a second dielectric constant for the insulative layer, and ~~ineffective to~~ that does not appreciably etch the first layer, where the second dielectric constant is in a range of about 2.5 to 2.0 and the whole insulative layer comprises $(\text{CH}_3)_x\text{SiO}_y$.

130. (previously presented) The method of claim 129 wherein a majority of carbon atoms present in the insulative layer are in the form of methyl groups, and wherein the methyl groups comprise from 10% to about 50% (mole percent) of the insulative layer.

131. (previously presented) The method of claim 129, wherein the insulative layer is configured to act as an interlevel dielectric layer.

132. (cancelled).

133. (previously presented) The method of claim 129, wherein the second dielectric constant is about ten percent less than the first dielectric constant.

134. (previously presented) The method of claim 129, wherein the second dielectric constant is about fifteen percent less than the first dielectric constant.

135. (withdrawn-currently amended) A method for forming an insulative layer having a relatively low dielectric constant comprising:

providing a substrate in a chemical vapor deposition apparatus;

providing a gaseous material precursor, an oxygen-comprising gaseous material and a plasma within the apparatus to form a first layer having a first dielectric constant over the substrate; and

after the depositing, exposing the first layer to an oxygen-comprising plasma ~~effective to form~~ that forms an insulative layer from the first layer, the insulative layer having a second dielectric constant lower than the first dielectric constant.

136. (previously presented) The method of claim 102, where blanket exposing occurs between plates of a dual plate capacitively coupled reactor for a time of from 20 to 100 seconds at a plate spacing of from 400 to 600 mils, a RF power range of from 300 to 1000 Watts, a pressure range of from 1 to 6 Torr, a temperature range of from 100 to 450°C, an oxygen comprising gas flow rate of from 500 to 1500 sccm, and an inert gas flow rate of from 200 to 800 sccm.

137. (previously presented) The method of claim 129, where blanket exposing occurs at a RF power range of from 300 to 1000 Watts, a pressure range of from 1 to 6 Torr, and a temperature range of from 100 to 450°C.

138. (previously presented) The method of claim 129, wherein the blanket exposing occurs between plates of a dual plate capacitively coupled reactor at a plate spacing of from 400 to 600 mils.

139. (previously presented) The method of claim 129, where blanket exposing occurs between plates of a dual plate capacitively coupled reactor for a time of from 20 to 100 seconds at a plate spacing of from 400 to 600 mils, a RF power range of from 300 to 1000 Watts, a pressure range of from 1 to 6 Torr, a temperature range of from 100 to 450°C, an oxygen comprising gas flow rate of from 500 to 1500 sccm, and an inert gas flow rate of from 200 to 800 sccm.